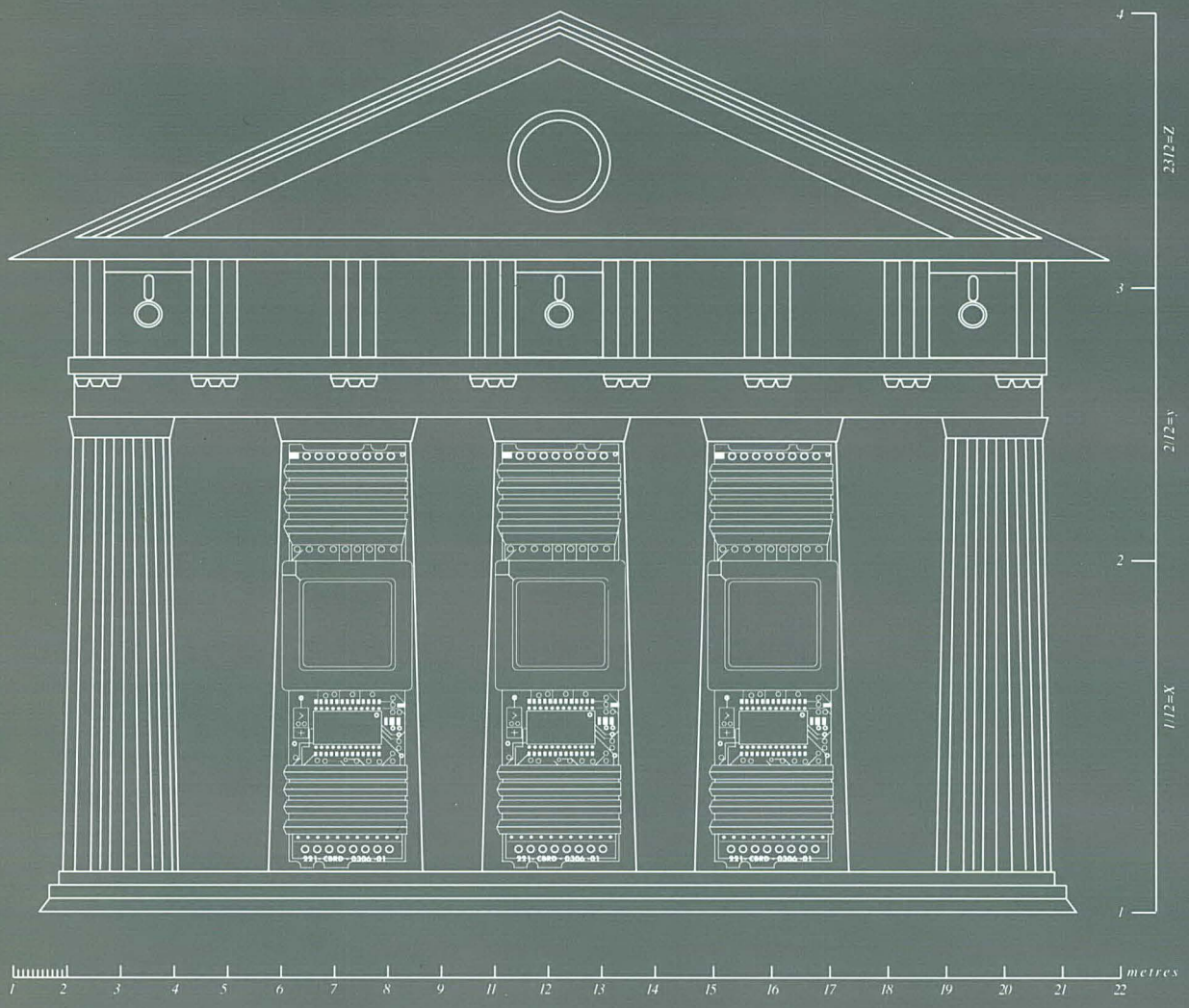
inmos

iq systems

product overview



integrating technology with established architectures

SGS-THOMSON MICROELECTRONICS

INMOS is a member of the SGS-THOMSON Microelectronics Group

iq

systems charter

To provide an extensive range of innovative modular hardware and software products to meet the high quality standards and service requirements of the OEM and system developer.

Contents

Introduction

During recent years there has been an explosion in the use of multiprocessing techniques. Signal and image processing algorithms easily consume the power of even the fastest uniprocessor systems. Additional hardware is commonly used with standard computers to accelerate number-crunching applications such as simulation, modelling and computer aided design (CAD).

The transputer has been at the forefront of this revolution. A high performance RISC microprocessor in its own right, the transputer uniquely incorporates four high speed serial links, allowing multiprocessor systems to be constructed with the minimum of effort. In addition, a range of sophisticated yet easy to use development software makes the transputer the number one choice for multiprocessing solutions - what INMOS calls 'Multiprocessing made simple'.

*i*q systems

***i*q** systems is the transputer business established by INMOS to service the needs of the system integrator. The product range includes a wide selection of industry standard hardware and software components designed specifically with the system integrator in mind. Produced in volume, these components represent a cost-effective solution for those customers not wishing to incur the additional expense and time-to-market penalties associated with in-house design.

TRAMs

Transputer **M**odules (TRAMs) are compact (typically smaller than a credit card), ready to use, sub-assemblies incorporating detailed transputer designs. A basic compute TRAM contains a transputer together with some fast local memory. More sophisticated versions include additional circuitry such as graphics input and output facilities. Comprehensive software libraries adhering to externally supported standards where appropriate are supplied, allowing the system integrator to concentrate on the application rather than low-level, hardware-dependent programming details.

Motherboards

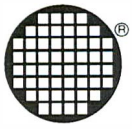
Along two sides of each TRAM are a small number of pins incorporating the transputer link signals which mate with sockets on a series of specially designed motherboards. Each motherboard provides an interface to a standard bus (PC-AT, VMEbus for example) and is able to accept a number of TRAMs. Device drivers ensure a consistent and well defined interface between host computers and motherboards, allowing complete networks of TRAMs to be integrated within many standard computing environments.

Networking

For larger systems, stand-alone operation may be more appropriate. To cater for these situations, the ***i*q** systems range includes components to allow booting from read-only memory, and local area network support using TCP/IP protocols over Ethernet. Thus, the system integrator has the flexibility to offer solutions accessible from any machine on the network.

Development Systems

One of the most important factors affecting time-to-market in the electronics industry is the quality of the available software development tools. Even before the introduction of the first transputer in 1985 INMOS had been writing compilers and other development utilities specifically for multiprocessor systems, and this experience is clearly evident in the latest products. Compilers for ANSI C, C++ and occam are augmented by other easy to use utilities such as debuggers, simulators and profilers to provide an extremely comprehensive environment. The software development tools are all designed specifically for use with the ***i*q** systems range of products.



Why Use TRAMs?

The TRAM's unique modular architecture provides a number of important benefits for the system integrator:

- **High performance**

  The processing power available to an application is increased simply by using more TRAMs. The performance of many applications will scale linearly as more TRAMs are added.

- **Upgradeability**

  As faster TRAMs become available, the system integrator is able to upgrade system performance by simply replacing the existing units. No hardware or software engineering effort is required.

- **Host independence**

  The modular approach means that exactly the same TRAMs can be used with a variety of different motherboards. Thus, the system integrator is able to offer a range of solutions based on different host computers with the minimum of design effort.

- **Time to market**

  Application software development can commence on the final target system immediately, eliminating hardware design delays. Conformance to external standards where appropriate aids the integration process, as do the comprehensive software development tools, designed specifically for multiprocessing applications.

- **Cost effectiveness**

  The *i*q systems products are priced to give dramatic savings as volumes increase. Development systems are competitive against alternative solutions, and extensive customer technical support is available during the early stages of a project.

Product Reference

Product Reference (continued)

Special Application TRAMs and Support Software (cont'd)	**Product code**	**Page**
DSP Development Tools And Libraries	IMS F007	20
SCSI Interface TRAM	IMS B422	21
SCSI Interface Libraries	IMS F002	21
Link Interface TRAM	IMS B415	21
Flash ROM TRAM	IMS B418	22
Ethernet TRAM	IMS B431	22
Ethernet Driver Software	IMS F006	22
IEEE–488 GPIB TRAM	IMS B421	23
IEEE–488 GPIB Libraries	IMS F001	23
Prototyping TRAM	IMS B430	23

Operating Systems and Kernels	**Product code**	**Page**
VRTX 32 Real Time Executive	Not applicable	24
Virtual Routing Configurer	IMS Dx224	24

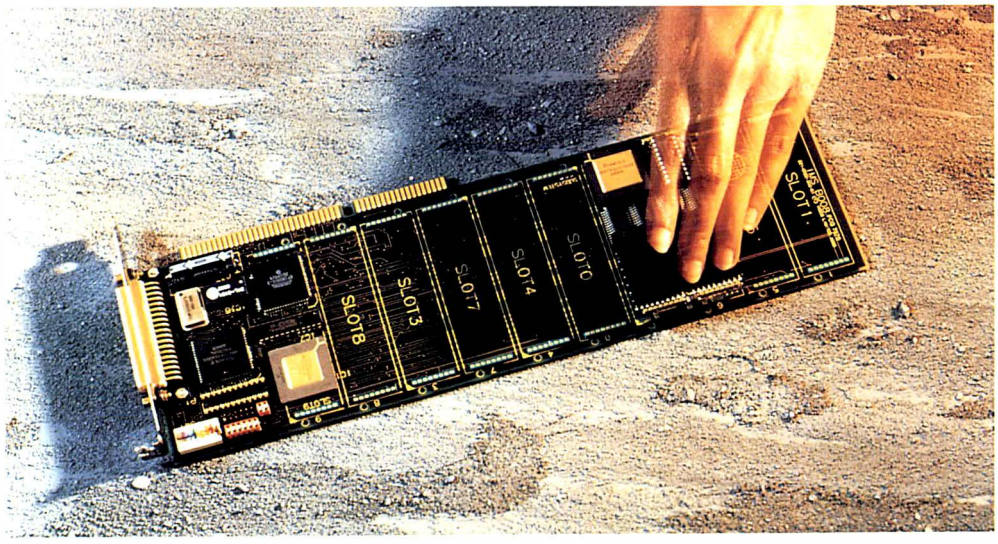
Development Systems Software	**Product code**	**Page**
ANSI C Toolset	IMS Dx214	25
C++ Toolset	IMS Dx217	25
occam2 Toolset	IMS Dx205	26
ALSYS ADA Compiler	Not applicable	26

Networking Solutions	**Product code**	**Page**
Ethernet to Transputer Gateway	IMS B300	27
Connection Manager Software	IMS Sx07	27
Differential System Port Board	IMS B019	28

Systems Support	**Product code**	**Page**
VME Rack	IMS B250	29
9U Card Frame Adapter	IMS CA12	29
Cable Sets	IMS CAxx	29

System Architecture

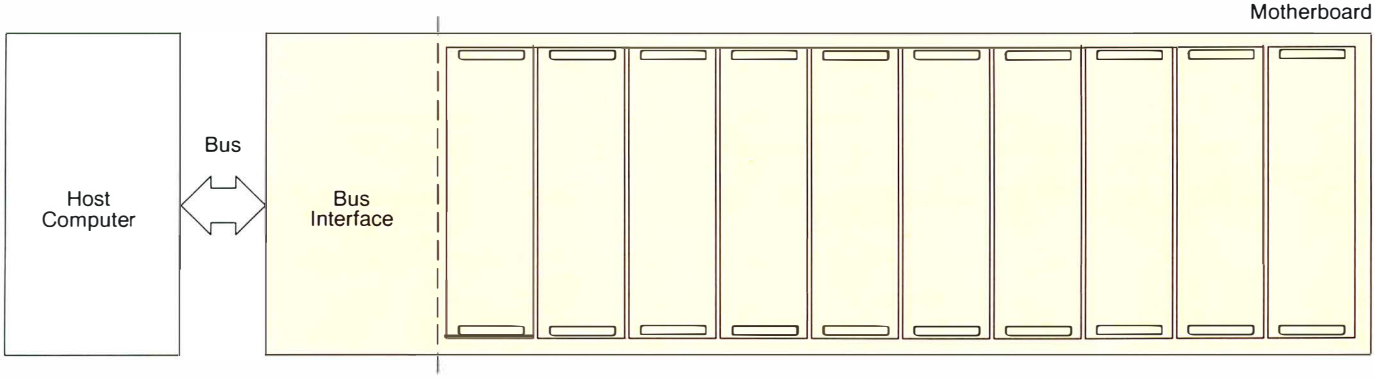
*i*q systems motherboards, TRAMs and software form a powerful set of building blocks, allowing the rapid development of prototyping systems and easy migration to production designs. This section describes the generic system architecture, explaining each of the product categories in turn. It demonstrates how *i*q systems' modular approach provides an unequalled flexibility in terms of host independence and architectural consistency, resulting in a faster time to market.



Motherboards

*i*q systems motherboards support the most popular bus architectures, facilitating the connection of TRAM-based systems to a variety of host computers and racked systems including IBM PC/AT, Micro Channel, VMEbus and Ethernet (using TCP/IP). The bus interface circuitry may be on the motherboard (for example, PC/AT on page 10), on a separate board (VMEbus master on page 11) or in a stand-alone box (Ethernet gateway on page 27).

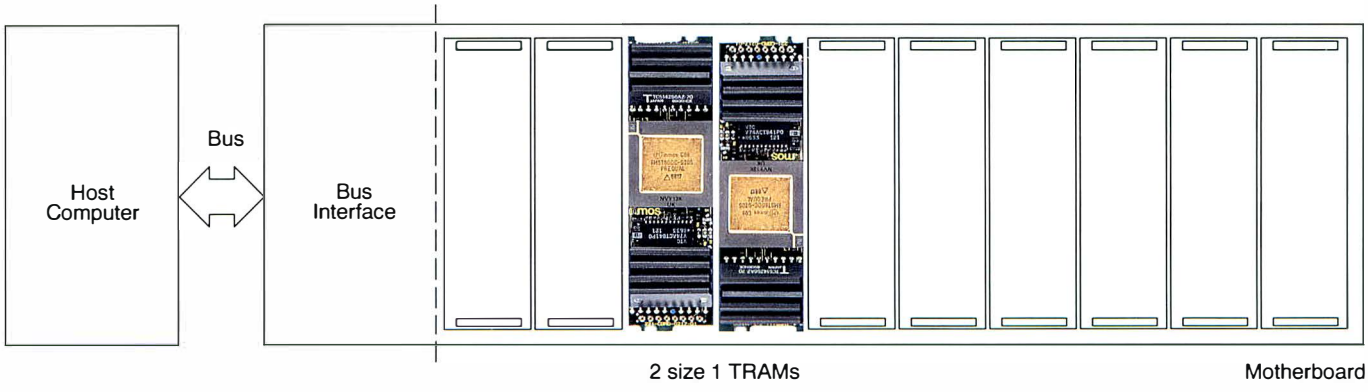
The bus interface circuitry is logically separated from the motherboard circuitry (where the TRAMs are installed). Thus, the TRAM network is host independent —that is, the system integrator can connect exactly the same hardware and software to a variety of host machines.



Compute TRAMs

Compute TRAMs are simply a transputer together with an amount of memory, mounted on small printed circuit boards. They are easily plugged into sockets on motherboards, and communicate via transputer link signals. A wide variety of transputer/RAM configurations are available (refer to page 14).

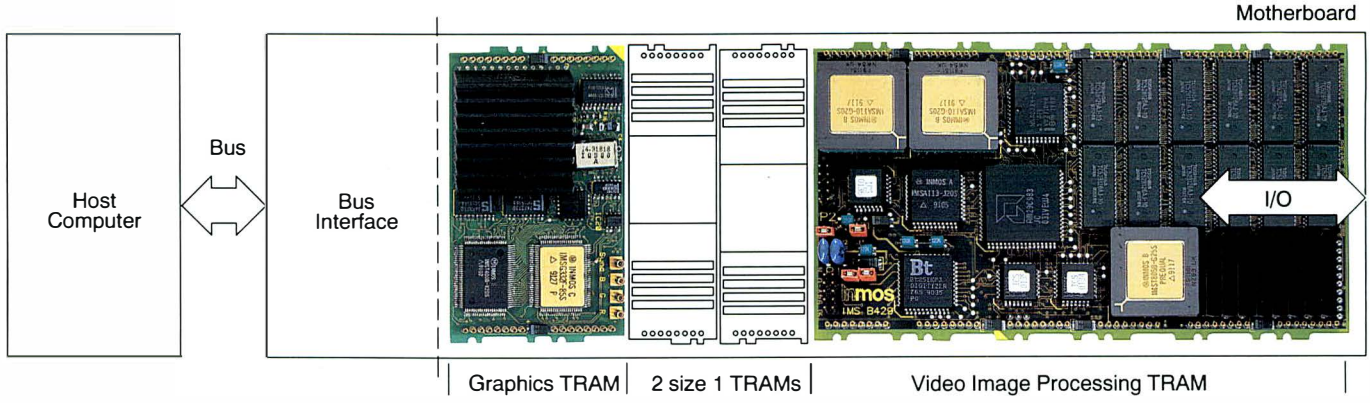
The diagram below shows two such TRAMs, each with a 30MHz transputer and 4Mbytes DRAM, installed on a motherboard. This is a typical configuration used for multiprocessor software development. All TRAMs are compatible with the INMOS ANSI C, C++ and occam Toolsets which are available for PC, SUN and VAX VMS development environments, (refer to page 25).



Application Specific TRAMs

Application specific TRAMs take the modular concept a stage further, adding extra circuitry to the transputer and memory to support a particular function. This additional capability may be I/O (for example graphics or SCSI) or computation support for specialised applications (vector processing).

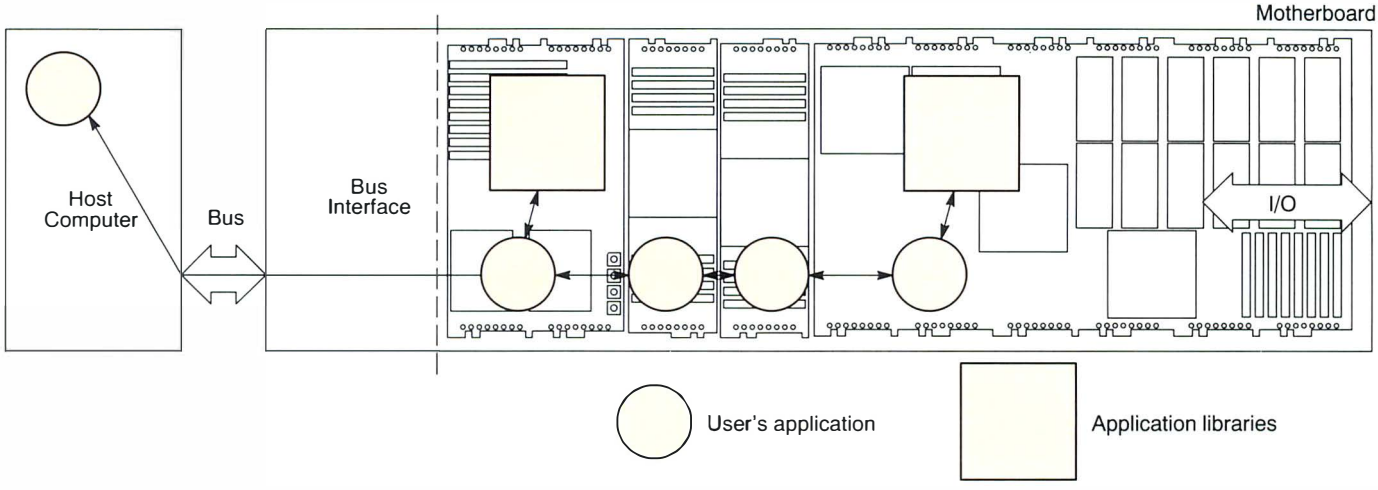
Two application specific TRAMs have been added to the diagram shown below: a graphics TRAM (page 19) and a Video Image Processing TRAM (page 18). These two modules add image capture, image enhancement, feature extraction and graphics display functionality to the system. A typical application of such a system would be production line inspection.



Application Libraries

Application TRAMs are typically supplied with library functions which allow the system integrator to concentrate on his application rather than low-level, hardware dependent programming details. These application libraries adhere to external standards where appropriate and are fully compatible with the INMOS development toolsets.

For example in a video application, the types of functions available to the programmer would be of the kind:
'capture_image',
'2D_convolve_region_of_interest',
'rotate_image' and 'overlay_text'.



Support Software

In addition to application libraries and multiprocessor development systems, other software products are available to help the system integrator build TRAM-based solutions as quickly and easily as possible.

Servers and device drivers allow the transputer network to make use of the host computer's system resources (e.g. filing system, keyboard and screen I/O). They present a consistent programming interface to the software engineer, maintaining the host independence of the TRAM architecture.

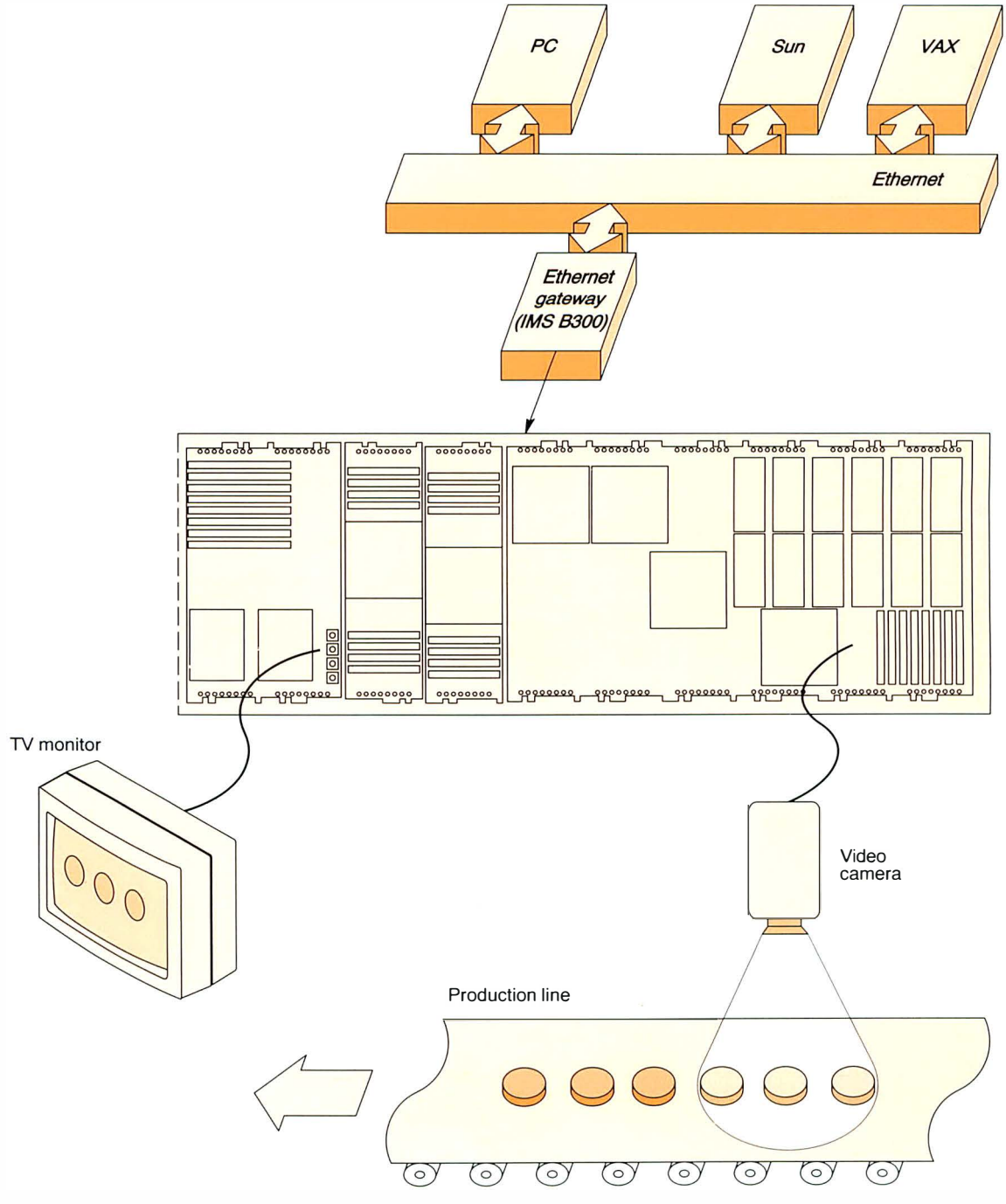
The Virtual Routing Configurer (page 24) creates a software routing layer which optimises routing connections and ensures the user does not have to explicitly specify routing or make source code changes if a different hardware architecture is used.

The VRTX real time executive, available from Ready Systems Corporation (page 24), enhances the transputer's concurrency model to give a real time, preemptive, multitasking model with fully deterministic operation.

Networked Systems

There are many applications where it makes sense to have the transputer system arranged as a networked resource, available to any computer system attached to the network. The *i*q systems Ethernet gateway product (page 27) allows transputer-based systems to be connected to an Ethernet LAN running TCP/IP protocols.

Thus, the production line application example is able to communicate with a number of host computers, sharing data with applications such as Statistical Process Control (SPC), materials handling, on-line maintenance data, and so on.



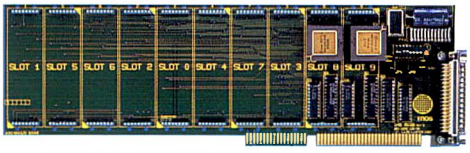
Standard Interface Boards and Support Software

Reference Table of Standard Interface Boards

Bus interface	Interface method	Number of TRAM slots	Memory	Board format	Product code	Page
IBM PC-AT	IMS C012[1]	10	-	Full length PC/AT card	IMS B008-1	10
VMEbus	Dual port DRAM	0	4M DRAM (IMS B016-1), 16M DRAM (IMS B016-4), 256K F-ROM, 256K SRAM	Double height (6U) VME	IMS B016-1 IMS B016-4	11
VMEbus	IMS C012[1]	8	-	Double height (6U) VME	IMS B014-1	11
Not applicable	Not applicable	8	64K SRAM, 256K F-ROM, 8K NVRAM	Double height (6U) VME	IMS B018-1	12
IBM Micro Channel	IMS C012[1]	4	-	IBM Micro Channel	IMS B017-1	13
NEC PC9801	IMS C012[1]	5	-	NEC board	IMS B015-1	13

Note: 1. The IMS C012 converts a bi-directional serial transputer link into a byte-wide parallel data stream.

IBM PC



IBM PC Motherboard

Features

- IBM PC-AT format board
- Ten transputer module (TRAM) slots
- IBM PC bus interface supports DMA and interrupts
- Software control of TRAM interconnect topology
- Connector permits system expansion
- Includes PC motherboard support software

Product code: **IMS B008**

The IMS B008 is a TRAM motherboard which plugs into the IBM PC-XT or PC-AT and provides an interface between the IBM PC and transputer-based systems. It has slots for up to ten TRAMs. Links 1 and 2 from each of the TRAM slots are 'hard wired' on the IMS B008, such that the TRAMs, when plugged in, form a pipeline of processing elements. The remaining links can be 'soft wired' using an INMOS IMS C004 programmable link switch. This arrangement allows a large variety of networks to be created under software control.

IBM PC Motherboard Support Software

Features

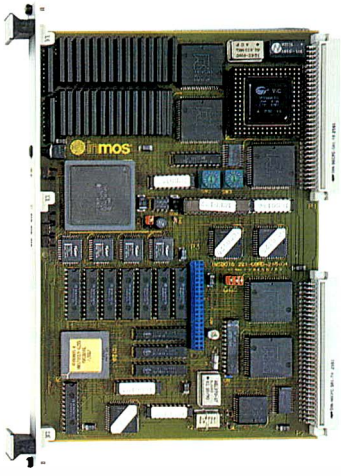
- PC compatible device driver
- INMOS server program, including sources
- Transputer network mapping tool
- Included with IMS B008

Product code: **IMS S708**

Allows transputer network access to:

- PC filing system
- Screen and keyboard I/O
- DOS system functions

VMEbus



VMEbus Master/Slave Board

Features

- IMS T801-25 transputer with 4 serial links for direct connection to transputer networks
- 256Kbytes private transputer SRAM (80ns cycle)
- 4 or 16 Mbytes dual-ported DRAM
- 256 Kbytes of programmable Flash ROM
- Full VMEbus interrupter and interrupt handler
- Real-time clock and DUART
- Includes IMS F008 support software
- Product code: **IMS B016**

The IMS B016 is a very high performance VMEbus master/slave board suited to all applications requiring fast data throughput between a transputer network and VMEbus peripherals. The board incorporates a 32-bit transputer, local RAM, peripherals and interface circuitry for efficient communication between the transputer and other VMEbus boards.

Dual access RAM is provided for access by both the transputer and other VMEbus masters. The transputer can perform master accesses to other VMEbus slaves. It can also interrupt other VMEbus interrupt handlers and itself handle VMEbus interrupts.

Sustained transfer rates in excess of 12Mbytes/s are achievable. The IMS T801 is capable of 12.5 MIPS (sustained) and has its own private fast SRAM for speed-critical code and data.

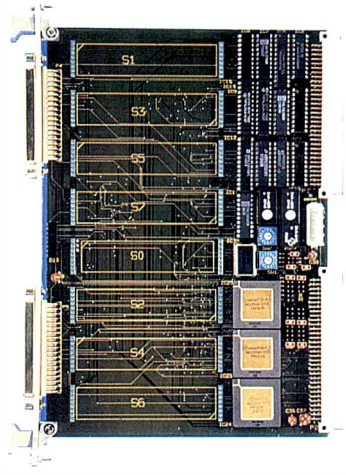
VMEbus Master/Slave Board Support Software

Features

- Board set-up procedures
- VMEbus interface routines
- Ready Systems VRTX32/T support (see page 24)
- Included with IMS B016
- Product code: **IMS F008**

The IMS F008 is a package of ANSI C source code components that act to demonstrate the features of the IMS B016 VMEbus master/slave board.

In addition, the IMS F008 includes the source code of a board support package for the VRTX32/T real-time executive (see page 24), allowing the developer to use the IMS B016 within this powerful environment.



VMEbus Slave Motherboard

Features

- Accommodates 8 standard TRAMs
- Software control of TRAM interconnect topology
- VMEbus slave interface
- Expandable to form arbitrarily large systems
- Product code: **IMS B014**

The IMS B014 motherboard is compatible with VMEbus Specification Revision C.1. It is a double height (6U) card, containing 8 TRAM slots with associated configuration circuitry and a VMEbus slave interface. Two IMS C004 crossbar link switches are provided to allow the user to configure the transputer link connections. This architecture allows any topology to be established on the board. Additionally, 24 links are brought to the edge connectors so that larger networks using multiple boards may be constructed.

VMEbus

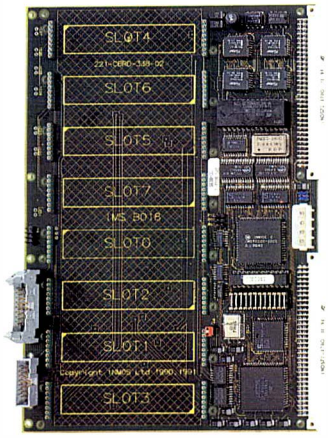
WARNING: if you are to install an IMS B016 or IMS B014 in a Sun workstation, refer to the IMS CA12 specification on page 29.

Sun Workstation Support Software

Features

- Sun3 and Sun4 device drivers
- INMOS server program, including sources
- Transputer network mapping tool
- Compatible with IMS B016 and IMS B014 VME bus boards, but must be purchased separately.
- Product code: **IMS S514**

The IMS B016 and IMS B014 boards can be plugged into any Sun workstation having an available VMEbus slot. The IMS S514 device driver allows the transputer board to be accessed via standard operating system calls. In addition, the server program permits the transputer network to communicate with the workstation filing system and the screen and keyboard I/O.



Stand-alone Motherboard

Features

- 8 TRAM slots
- IMS T222 transputer
- 64 Kbytes SRAM
- 256 Kbytes Flash ROM
- 8K non-volatile SRAM
- Real time clock and two RS232 serial ports
- 6U VME board profile
- Includes Flash ROM support software
- Product code: **IMS B018**

The IMS B018 is designed to be used in stand-alone applications not requiring a direct connection to a host computer. The board is fitted with an IMS T222 16 bit transputer, controlling all the peripheral circuits.

Flash ROM is provided to allow the TRAM network to be bootstrapped when power is applied.The Flash ROM can also be used for data storage. A battery-backed SRAM is provided for storing small amounts of frequently changed data. The battery also maintains a real time clock when power is removed from the board. 64K of zero wait state SRAM is provided for running programs.

Two serial ports allow connection to a wide variety of computer equipment. Four subsystem ports permit independent control of up to four transputer systems for use in fault tolerant or multi-user systems.

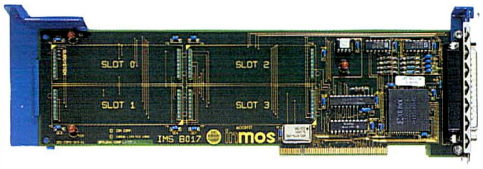
Flash ROM Support Software

Features

- Flash ROM programming utility
- Libraries to access IMS B018 hardware facilities
- Supplied with IMS B018
- Product code: **IMS F010**

The IMS F010 allows the system integrator to easily configure a self-booting application, and program the code into flash-ROM devices on the IMS B018 motherboard. On system reset, this code will be booted into the TRAMs mounted on the motherboard and initialsed.

IBM Micro Channel



IBM Micro Channel Motherboard

Features

- IBM Micro Channel bus format board
- Four TRAM slots accommodating size 1 or size 2 transputer modules
- Provides a gateway to larger transputer networks from Micro Channel based systems
- Link adapter interface to the Micro Channel bus
- Includes PS/2 motherboard support software
- Product code: **IMS B017**

The IMS B017 is a motherboard designed to plug into a Micro Channel bus. The board has four TRAM slots and an interface to the Micro Channel bus.

The Micro Channel bus interface provides a single INMOS serial link and a system services port. Software running on the Micro Channel based system can reset, analyse, communicate with, and monitor the error flag of a transputer network on or connected to the IMS B017. Data can be transferred to and from the link interface using programmed I/O.

PS/2 Motherboard Support Software

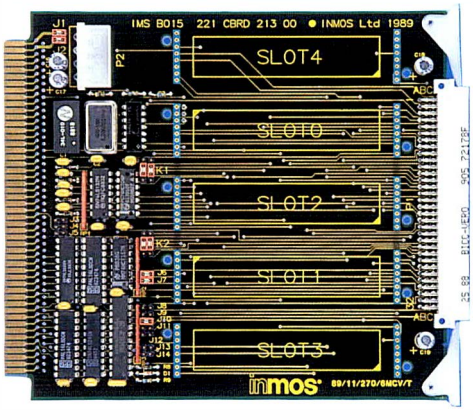
Features

- IBM PS/2 compatible OS/2 device driver
- INMOS server program, including sources
- Transputer network mapping tool
- Included with IMS B017
- Product code: **IMS S217**

Allows transputer network access to:

- PS/2 filing system
- Screen and keyboard I/O
- OS/2 system functions

NEC PC9800



NEC PC9800 Motherboard

Features

- 5 slots for INMOS TRAMs
- INMOS link adaptor interface to the NEC expansion bus
- Interrupt capability
- Choice of I/O address
- Product code: **IMS B015**

The IMS B015 is a TRAM motherboard for the NEC PC-9800 series of personal computers. It allows transputer modules to be fitted to a 9800 series PC for program development and application acceleration.

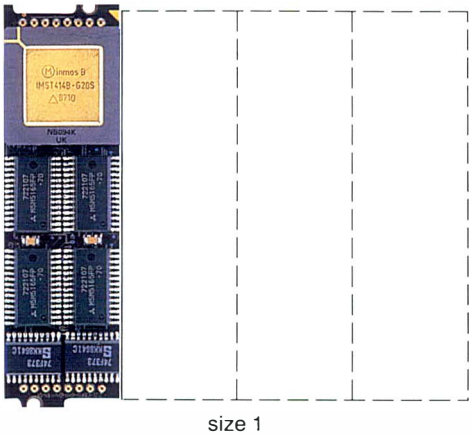
The IMS B015 has five sites for TRAMs and an interface to the 9800 series PC expansion bus. This allows the PC to communicate with and reset the TRAMs. It also has connections which allow it to connect to other transputers, TRAMs, or transputer boards such as another IMS B015.

Compute Only TRAMs

Reference Table of Compute Only TRAMs

Total memory size	Transputer -MHz	SRAM/ cycles	DRAM/ cycles	TRAM size	Sub-system	Product code	Page
32 Kbytes	T425-25	32K/3	-	1	No	IMS B401-8	14
32 Kbytes	T805-20	32K/3	-	1	No	IMS B401-15	14
32 Kbytes	T805-25	32K/3	-	1	No	IMS B401-16	14
64 Kbytes	T222-20	64K/2	-	1	No	IMS B416-10	15
160 Kbytes	T801-20	160K/2	-	2	No	IMS B410-11	15
1 Mbyte	T425-20	-	1M/3	1	No	IMS B411-7	15
1 Mbyte	T805-20	-	1M/3	1	No	IMS B411-15	15
2 Mbyte	T425-25	-	2M/3	2	Yes	IMS B404-8	16
2 Mbyte	T805-20	-	2M/3	2	Yes	IMS B404-15	16
2 Mbyte	T805-25	-	2M/3	2	Yes	IMS B404-16	16
2 Mbyte	T801-25	-	2M/2	2	Yes	IMS B428-12	16
4 Mbyte	T805-25	-	4M/3	1	No	IMS B426-16	16
4 Mbyte	T805-30	-	4M/3	1	No	IMS B426-17	16
8 Mbyte	T805-25	-	8M/4	2	Yes	IMS B427-16	17
16 Mbyte	T805-25	64/3	16/4	4	Yes	IMS B433-16	17

32 Kbyte TRAM



size 1

Features

Choice of transputer (IMS T425 or IMS T805)

Choice of processor speed (20 or 25MHz)

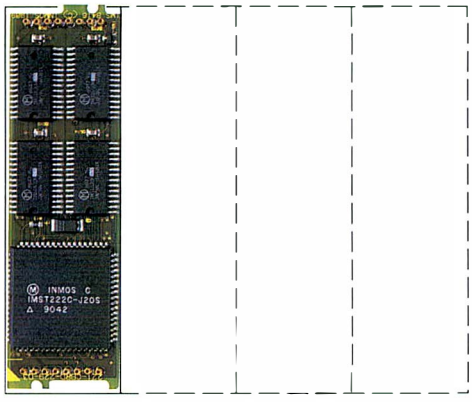
32 Kbytes of zero-wait-state SRAM

Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B401**

The IMS B401 is ideal for applications where 4 Kbytes of on-chip RAM is not quite enough. The 32 Kbytes of off-chip RAM is ideal for systolic processing, signal processing, feature extraction etc.

64 Kbyte TRAM



size 1

Features

IMS T222-20 transputer

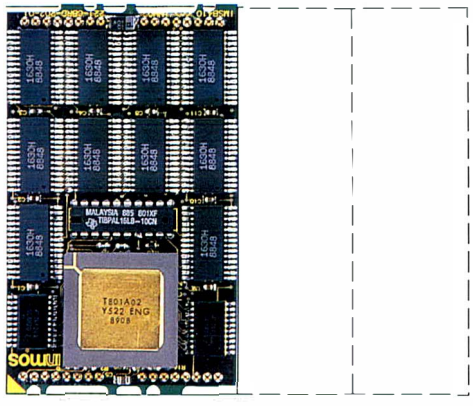
64 Kbytes of zero-wait-state SRAM
(100ns memory cycle time)

Communicates via 4 INMOS serial links
(Selectable between 10 or 20 Mbits/s)

Product code: **IMS B416**

The IMS B416 utilises the full memory space of the IMS T222 transputer. It is manufactured fully from surface mount silicon components, providing a cheap yet powerful 16-bit processor in a standard size 1 TRAM package.

160 Kbyte TRAM



size 2

Features

IMS T801-20 transputer with de-multiplexed address and data buses

160 Kbyte of zero-wait-state SRAM
(100ns memory cycle time)

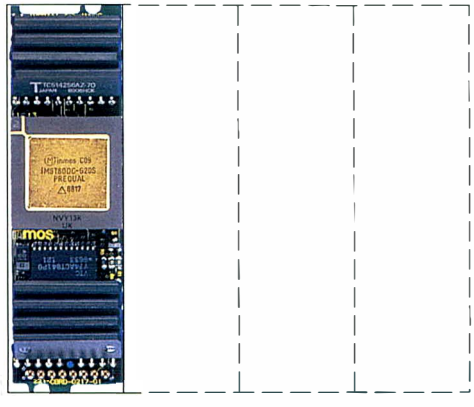
Communicates via 4 INMOS serial links
(Selectable between 10 or 20 Mbits/s)

Product code: **IMS B410**

The de-multiplexed address and data buses of the IMS T801 transputer allow very high performance systems to be constructed. The IMS B410 TRAM achieves 2-cycle memory accesses with very fast SRAMs, and yet still manages to squeeze 160 Kbytes onto a size 2 TRAM.

The IMS B410 TRAM allows users to benchmark the performance of the IMS T801 transputer. The standard TRAM interface means that the processor can simply be plugged into existing development systems. However, this module is equally at home in very high performance system products as it is in the evaluation environment.

1 Mbyte TRAM



size 1

Features

Choice of transputer (IMS T425 or IMS T805)

Choice of processor speed (20 or 25MHz)

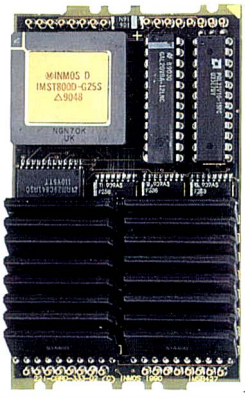
1 Mbyte of zero-wait-state SRAM
(150ns memory cycle time)

Communicates via 4 INMOS serial links
(Selectable between 10 or 20 Mbits/s)

Product code: **IMS B411**

Using the latest ZIP memory packaging technology, the IMS B411 TRAM combines a high performance transputer with a full megabyte of zero-wait-state DRAM. The result is a compact, cost effective module with sufficient storage capacity to handle a wide range of applications. The IMS B411 is offered with the full range of transputer and speed selections, allowing the user the flexibility to tailor the system to an exact specification.

2 Mbyte TRAM



size 2

Features

Choice of IMS T805 or T425 transputer up to 25MHz

2 Mbytes of zero-wait-state DRAM

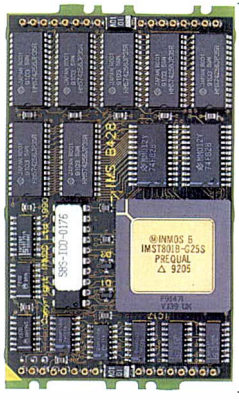
Subsystem controller circuitry

Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B404**

The IMS B404 is approximately the same size as a credit card. Within this area is packaged a full two megabytes of DRAM, with access times sufficiently fast to allow the transputer to process at full speed, even when running at 25MHz. A wide range of transputer and speed options are available making this board ideal as the basis of a standard transputer development system.

2 Mbyte TRAM



size 2

Features

IMS T801-25 transputer

2 Mbytes zero-wait-state DRAM

2 cycle access (typical),
3 cycle access (worst case)

Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B428**

The IMS B428 provides a new option to users wanting maximum performance from transputer-based systems. The IMS T801 floating point transputer features separate address and data busses allowing memory cycles to be completed in two clock cycles. New generation non-multiplexed DRAMs are used to take advantage of this high bandwidth (50 Mbytes/second) memory interface. The result is a compact unit with enough memory to run major applications significantly faster than designs using a multiplexed bus.

4 Mbyte TRAM

size 1

Features

IMS T805 transputer running at 25MHz or 30 MHz

4 Mbyte of zero wait-state DRAM

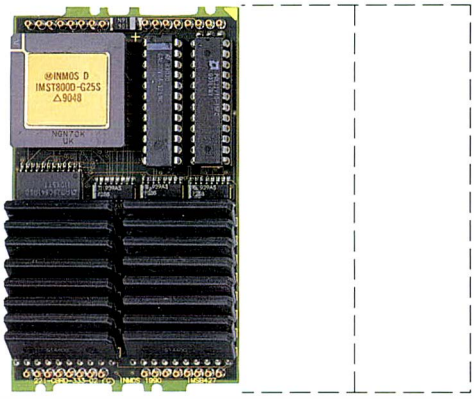
Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B426**

The IMS B426 TRAM is the ideal product for applications where top performance is required, but space is at a premium. Using the latest technology, 4Mbytes of memory and a high speed transputer are packed onto a circuit board half the size of credit card. Even at 30MHz, this powerful combination performs memory accesses at full speed. This powerful processing element is so compact that 8 such boards (120 MIPS sustained and 32 Mbytes RAM) can be installed in a single 6U VMEbus slot.

INMOS will make further use of 30MHz transputers as faster DRAMs become available. Contact your local INMOS representative for the latest developments.

8 Mbyte TRAM



size 2

Features

25MHz IMS T805 transputer

8 Mbytes of single-wait-state DRAM (160 ns memory cycle time)

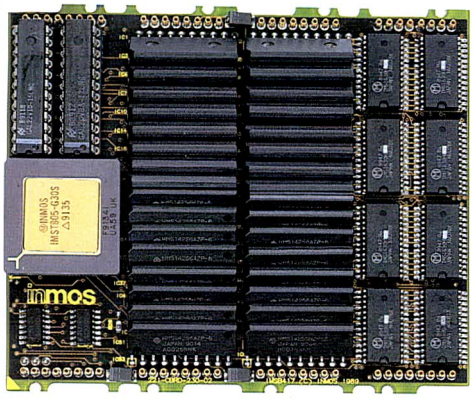
Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B427**

The IMS B427 is a compact size 2 TRAM offering 8Mbytes of 4-cycle DRAM and subsystem controller circuitry.

With a large amount of external memory, the IMS B427 is able to run all of the INMOS development tools including the ADA compiler from Alsys. It is ideally suited for applications using large amounts of memory, allowing progams such as simulation and AI evaluation to run quickly and efficiently.

16 Mbyte TRAM



size 4

Features

IMS T805 25MHz transputer

64 Kbytes of zero-wait-state SRAM

16 Mbytes of single-wait-state DRAM

Subsystem controller circuitry

Communicates via 4 INMOS serial links (Selectable between 10 or 20 Mbits/s)

Product code: **IMS B433**

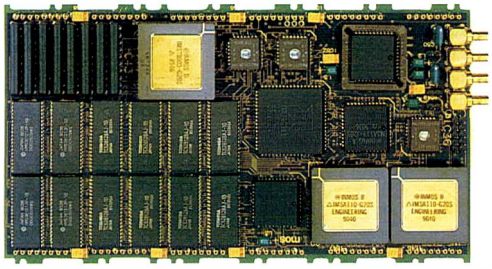
The IMS B433 uses the IMS T805 25MHz transputer. The 16 Mbytes of single-wait-state DRAM is sufficient to run large applications. Also provided is 64 Kbytes of fast SRAM (3 cycle), so any technique which puts most frequently accessed memory locations near the bottom of memory will speed up the processing.

Special Application TRAMs and Support Software

Reference Table of Special Application TRAMs

Description	Transputer -MHz	TRAM size	Sub-system	Product code	Page
Video Image Processing TRAM	T805-25	6	No	IMS B429-16	18
Top Performance Graphics TRAM	T800-20	6	Yes	IMS B419-4	19
Compact Display TRAM	T805-25	2	No	IMS B437-16	19
Vector Processing TRAM	T800-20/25	4	Yes	IMS B420-3/5	20
SCSI Interface TRAM	T222-20	2	Yes	IMS B422-10	21
Link Interface TRAM (2 off)	-	1	No	IMS B415-1	21
Flash ROM TRAM	T222-20	2	Yes	IMS B418-10	22
Ethernet TRAM	T222-20	2	No	IMS B431-10	22
IEEE-488 GPIB TRAM	T222-20	4	Yes	IMS B421-10	23
Prototyping TRAM	T222-20	4	No	IMS B430-10	23

Video Image Processing



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Video Image Processing TRAM (VIPTRAM)

Features

- Real time (30f/s) monochrome image capture
- 2D image filtering
- Supports PAL, NTSC, and other image formats
- Programmable capture resolution and sampling rate: for example 512x512
- Supplied with IMS F004 image processing libraries
- Product code: **IMS B429**

The IMS B429 is a TRAM for real-time image capture and front-end image processing, a capability provided by two IMS A110 image processing devices. These can perform 2D convolution filtering operations with filter kernels of various sizes up to 7×6, 14×3, or 42×1.

The on-board IMS T805 transputer, with 1Mbyte of RAM, acts as a central processor and provides a more general purpose processing capability for functions such as feature extraction.

Video Image Processing Libraries

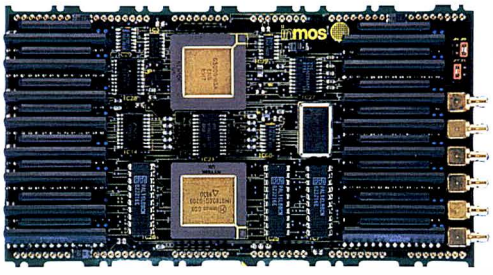
Features

- Provides access to all IMS A110 features
- Compatible with INMOS ANSI C, C++ and occam Toolsets (IMS Dx214, IMS Dx217 and IMS Dx205 respectively)
- Product code: **IMS F004**

Suitable applications are:

- Industrial inspection
- Machine vision
- Optical character recognition
- Document image processing
- Automated traffic monitoring

Graphics



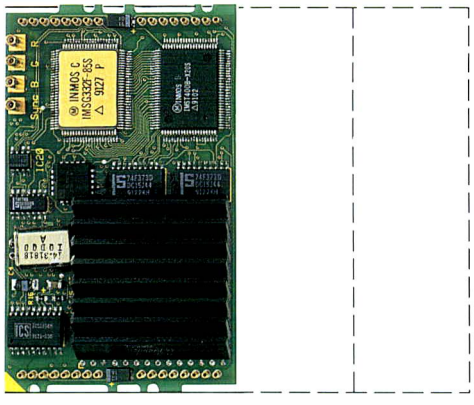
size 6

Top Performance Graphics TRAM

Features

- IMS T800-20 32 bit transputer
- IMS G300B Colour Video Controller
- 2 Mbytes of DRAM and 2 Mbytes of VRAM
- Huge variety of software selectable screen formats
- Pixel rates 25 to 100MHz at 8 bit/pixel
- Includes IMS F003 graphics library
- Product code: **IMS B419**

The IMS B419 incorporates the IMS G300B Colour Video Controller (CVC) with the IMS T800 32-bit floating point transputer to form a high performance graphics system. Two Mbytes of four cycle DRAM provide a general purpose store sufficient to run applications such windowing environments. 2 Mbytes of Video RAM provide arbitrary screen resolutions up to a maximum of 1280x1024 of 8 bit/pixel, with unrestricted screen formats at resolutions below this.



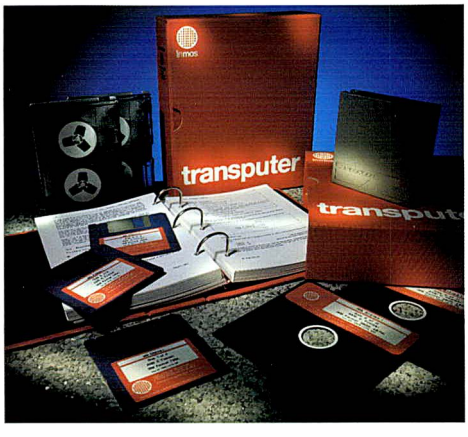
size 2

Compact Display TRAM

Features

- IMS T805-25 transputer and IMS G332 CVC
- 1Mbyte video RAM for screen and program
- Software selection of 1,2,4,8,15/16 bits per pixel
- Supports interlaced and non-interlaced displays
- Hardware cursor
- Includes IMS F003 graphics library
- Product code: **IMS B437**

The IMS B437 is an ideal product to support embedded graphics output when space is at a premium. Used with the IMS B429 VIPTRAM (page 18), a complete image processing system can be installed in a single 6U VME or PC-AT slot. Compact design includes the latest IMS G332 CVC capable of 15/16 bit, gamma-corrected true colour display. 1 Mbyte of video RAM supports screen resolutions up to 1024x1024 (8 bits per pixel).



2D Graphics Software

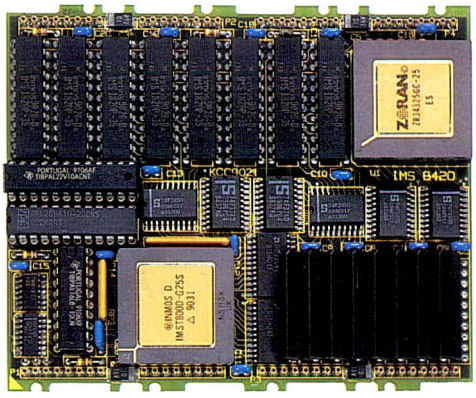
Features

- Subset of the CGI (ISO TC97/SC21 N1179) standard
- Separates CGI functions from hardware specific details
- Compatible with INMOS ANSI C, C++ and occam Toolsets (IMS Dx214, IMS Dx217 and IMS Dx205 respectively)
- Included with IMS B419 and IMS B437 graphics TRAMs.
- Product code: **IMS F003**

Suitable applications are:

- Graphical user interfaces
- Scientific data presentation
- Interactive drawing packages
- Computer Aided Design (CAD)
- Computer animation

Vector Processing



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Vector Processing TRAM (VecTRAM)

Features

IMS T800 (20 or 25MHz) floating point transputer

High performance vector/signal processing co-processor (ZR34325)

4 INMOS serial communication links allowing connection of multiple VecTRAMs

1 Mbyte DRAM

256 Kbyte, dual access SRAM

Supplied with IMS F000 vector processing libraries

Further DSP libraries available separately (IMS F007)

Product code: **IMS B420**

The IMS B420 VecTRAM is a transputer module combining the communications ability and scalar floating point performance of the IMS T800 with a high performance vector/signal processing co-processor (ZR34325). The two processors operate concurrently, using separate dynamic and static memory blocks. The vector/signal processor operates as a slave to the IMS T800 which sets up vector/DSP routines as well as loading data for processing. The two processors handshake via interrupts.

The IMS B420 is capable of performing a 1K complex FFT in less than 2ms, a 10x10 matrix multiplication in 135µs and a 64-tap FIR in 6µs.

Vector Processing Library

Features

Wide variety of common vector/signal processing functions

Transparent operation means that user is able to concentrate on algorithm development rather than low level hardware programming

Compatible with INMOS ANSI C, C++ and occam Toolsets (IMS Dx214, IMS Dx217 and IMS Dx205 respectively)

Product code: **IMS F000**

Suitable applications are:

- Speech and image processing
- Radar, sonar, ultrasonics, etc.
- Data compression and encryption
- Seismic/geophysical analysis

DSP Development Tools and Libraries

Features

Library of more than 100 ANSI C signal/vector processing routines

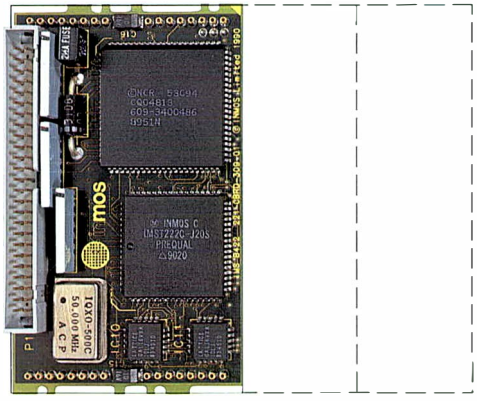
Allows programmers to create new library routines

Used in conjunction with Zoran DSP development system

Product code: **IMS F007**

The IMS F007 includes a comprehensive set of vector/signal processing routines. However, there will always be times when the precise function required is not available (for example radix-3 FFT). The IMS F007, when used in conjunction with the Zoran development system, allows the programmer to build custom vector operations.

SCSI Interface



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SCSI Interface TRAM

Features

- IMS T222-20 transputer
- SCSI bus interface (single ended drivers)
- Sustained SCSI transfer rates up to 1.5 Mbytes/s
- Target and initiator modes
- Subsystem port
- Supplied with SCSI interface libraries
- Product code: **IMS B422**

The IMS B422 SCSI TRAM acts as an interface between 4 INMOS links and a SCSI bus as defined in the ANSI X3.131-1986 standard. It allows transputer systems to connect to Winchester disks, optical disks, and other peripherals via the SCSI bus. The SCSI TRAM consists of an IMS T222 16-bit transputer with 64 Kbytes of SRAM for program and data buffers. An intelligent interface device is used to implement the connection to the SCSI bus which allows common sequences to proceed without intervention from the IMS T222. Target and initiator modes are supported. Applications include fast data logging and disk arrays.

SCSI Interface Libraries

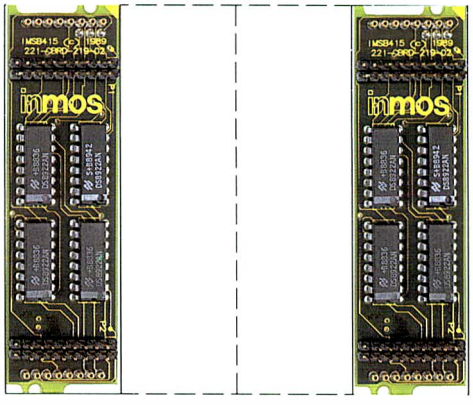
Features

- Supports Common Command Set (SCSI commands for Direct Access Drives)
- Permits 4 transputer channels to SCSI bus
- Example software (target and initiator modes) supplied
- Compatible with INMOS ANSI C, C++ and occam Toolsets (IMS Dx214, IMS Dx217 and IMS Dx205 respectively)
- Product code: **IMS F002**

Suitable applications are:

- Fast embedded storage for transputer systems
- Disk arrays
- Optical storage systems
- Computer animation from disk

Link Interface



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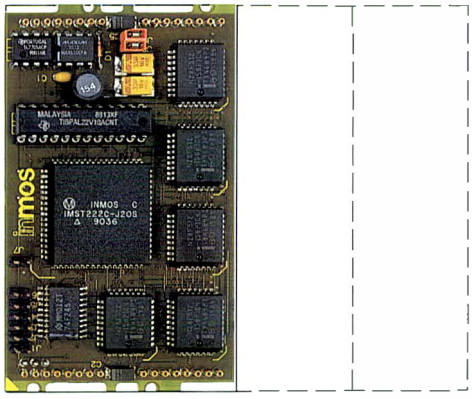
Link Interface TRAM

Features

- TRAM signals buffered to RS422-compatible differential drive
- Each TRAM handles 4 links reset and subsystem signals
- Capable of 20 Mbits/s link operation
- Links go quiet when disconnected
- Designed for 100Ω twisted pair cable
- Package includes 2 TRAMs plus 1m cable
- Product code: **IMS B415**

The IMS B415 differential interface TRAMs allow connections between transputer systems which are not in the same electrical environment. No common ground connection is required, reducing earthing problems. With cable lengths up to 10m, 20 Mbit/s link speed is possible. Longer cables up to 100m support lower link speeds.

Flash ROM



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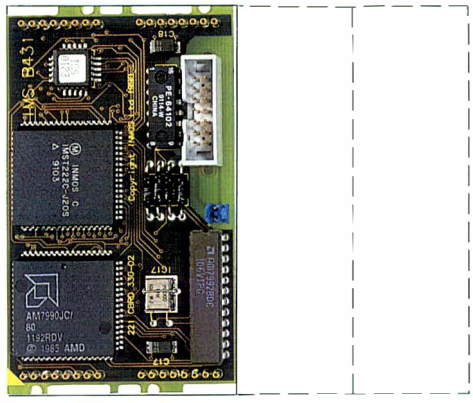
Flash ROM TRAM

Features

- IMS T222-20 transputer
- 256 Kbytes non-volatile memory (Flash ROM)
- 10 000 program/erase cycles
- Ideal for booting embedded transputer systems
- Can be used as non-volatile backup memory
- Product code: **IMS B418**

The IMS B418 is a TRAM designed primarily for configuring and boot-strapping transputer networks in embedded systems. It contains 256 kbytes of non-volatile memory: implemented with Flash ROM devices (the Flash ROM is an EPROM-like device with bulk electrical erasability). After reset, the IMS B418 outputs a program stored in the ROM from one of its INMOS serial links. An on-board programming voltage generator, and programming firmware, allows the ROM contents to be programmed through one of its links using any INMOS toolset.

Ethernet



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Ethernet TRAM

Features

- Connects transputer systems to IEEE802.3 Local Area Networks (Ethernet)
- IMS T222, 16-bit transputer
- 64 Kbytes SRAM, 100ns access cycle
- Uses MK7990 (LANCE) Ethernet Controller
- Communicates via 4 INMOS serial links
- Includes Ethernet driver software (IMS F006)
- Product code: **IMS B431**

The IMS B431 allows transputer systems to be connected to other computers and computer networks via IEEE802.3 Local Area Networks (LANs). It consists of an IMS T222 16 bit transputer with 64 Kbytes of SRAM. The Ethernet interface is implemented with the MK7990 (LANCE) and MK68592. An Attachment Unit Interface (AUI) is provided for connection to Ethernet Media Access Units.

The IMS B431 is suitable for integration into end equipment. Customers requiring a 'turn-key' standalone interface for TCP/IP over Ethernet to transputer links should first consider the Ethernet connection system, IMS B300, in conjunction with IMS Sx07 network support software.

Ethernet Driver Software

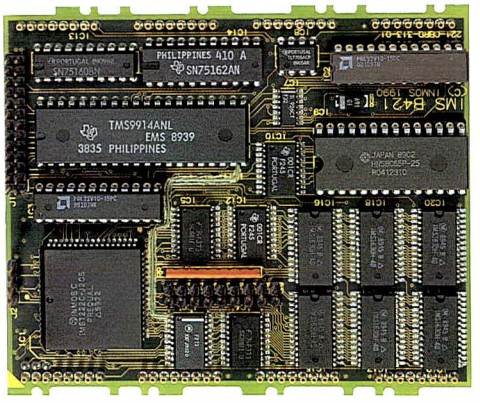
Features

- Provides Ethernet packet read/write functions
- Fast low-overhead, low-level communications
- Compatible with INMOS ANSI C, C++ and occam Toolsets (IMS Dx214, IMS Dx217 and IMS Dx205 respectively)
- Supplied with IMS B431 Ethernet TRAM
- Product code: **IMS F006**

Suitable applications are:

- Simple Ethernet/transputer link interfaces
- Remote crate-to-crate communications
- Dedicated Ethernet communication links
- Basis on which to build higher-level protocols (for example TCP/IP)

IEEE-488 GPIB



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IEEE-488 GPIB TRAM

Features

- IMS T222 transputer
- 48Kbytes of two-cycle RAM
- Full electrical compliance with IEEE 488
- Switchable GPIB bus address
- Supplied with GPIB library software
- Product code: **IMS B421**

The IMS B421 GPIB TRAM allows IEEE 488 test and instrumentation systems to be directly connected to networks of transputers. The parallel interface permits high speed communication of control and measurement information, and the power of the transputer can provide sophisticated data analysis facilities. The user can define the characteristics of the GPIB interface in terms of address etc. for maximum flexibility in system configuration.

IEEE-488 GPIB Libraries

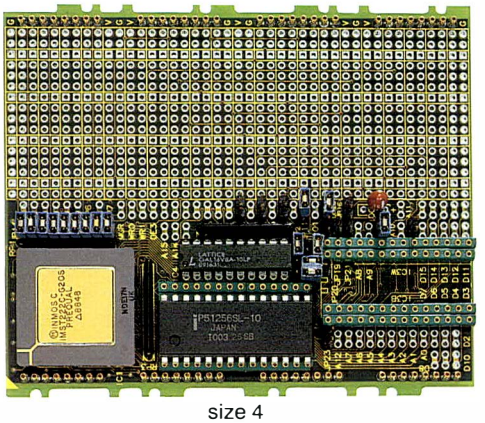
Features

- Performs all commonly required GPIB activities
- Supports GPIB system controller and talker/listener modes
- Compatible with IMS Dx205 occam and IMS Dx214 ANSI C Toolsets
- Included with IMS B421 GPIB TRAM
- Product code: **IMS F001**

Suitable applications are:

- Control of scientific test and measurement instrumentation
- Control and processing for automatic test rigs
- Compute-intensive GPIB data processing on an adjacent transputer network
- Transputer-based GPIB instruments
- Process control
- Data logging

Prototyping TRAM



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Features

- IMS T222 16-bit transputer
- User-programmable wait state generator
- Two JEDEC user configurable memory sockets with 32Kbyte of SRAM fitted as standard
- Large through-hole matrix prototyping area
- Includes full schematic diagrams and examples
- Product code: **IMS B430**

The IMS B430 combines a simple transputer system with a general purpose prototyping area. The product supports feasibility investigations, software development, demonstrations, and other activities requiring construction of a small number of units to a specific design. Inclusion of a functional transputer system speeds up the prototyping process significantly. The user is relieved of the tasks of defining, constructing and debugging such a system, and need only be concerned with the peripheral hardware specific to the intended application.

Operating Systems and Kernels

VRTX Real Time Executive

READY SYSTEMS

Features

- Fully deterministic operating system
- Preemptive, 256 levels of task priority
- Controllable timeslicing of equal priority tasks
- Multiprocessor operation
- Flexible memory allocation scheme
- Mailboxes
- Queues
- Event flags and event flag groups
- Fully counting semaphores
- Fully compatible with latest INMOS transputers, TRAMs and motherboards
- Designed specifically for use with IMS Dx214 ANSI C Toolset and IMS Dx224 Virtual Routing Configurer
- Can be obtained from Ready Systems Corporation direct or from one of its franchised distributors

In real time embedded systems, the application must respond in a predetermined time to external events and ensure critical activities are given high priority. The design of real time systems usually breaks the software into multiple tasks sharing data and exchanging messages. The tasks are allocated a priority in line with their critical importance in the system.

Ready Systems has made available the popular VRTX executive on the transputer. This version enhances the standard executive by supporting its use in distributed systems. A consistent transputer development environment has been retained with VRTX by supporting the INMOS ANSI C toolset.

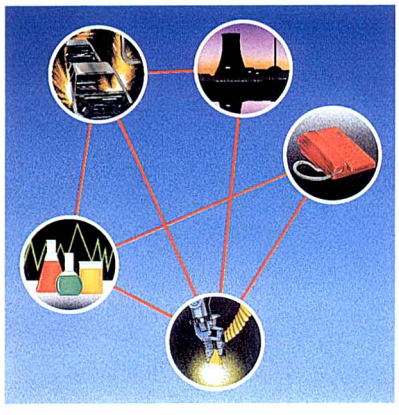
VRTX32 is fully deterministic; all function calls complete within predictable execution time limits. Determinism is of critical importance within predefined time constraints—a late response can be worse than no response at all.

VRTX32 provides comprehensive support for semaphores, event flags and mailboxes. VRTX32 gives full access to these mechanisms and preserves the preemptive behaviour of the executive.

VRTX32 uses a fully deterministic memory scheme with the flexibility of variable size block allocation. Memory is partitioned into regions, from which memory blocks can be allocated. Partitions can overlap or be located on memory mapped peripherals, for example, to implement shared memory I/O.

VRTX32 is fully compatible with the INMOS ANSI C toolset with mixed language support of C++ and ANSI C.

Virtual Routing Configurer



Features

- Configuration source language compatible with ANSI C Toolset configurer
- High performance software routing algorithms
- Automatic creation of multiplex, demultiplex and through routing system processes
- User control over routing
- Full reporting of routing mechanisms used
- Compatible with INMOS ANSI C (Dx214), occam (Dx205) and C++ (Dx217) Toolsets
- Product code: **IMS Dx224**

The virtual routing configurer and libraries provide a high performance software routing layer for use in multiprocessor systems. This relieves the programmer of the task of choosing and placing communication routes. It also eliminates the user task of creating and modifying custom routing source code when a process configuration is changed. The virtual routing system can be used for sophisticated message routing in development or production systems. The user can control routing through a number of mechanisms, the configurer reporting all routing processes it creates.

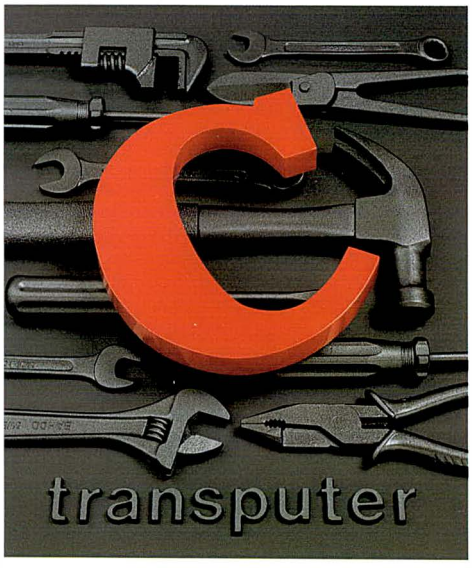
Development Systems Software

Within the *i*q systems product family, a range of development software products has been created to offer the applications developer integrated, highly functional packages designed to increase system reliability and reduce development costs.

INMOS has applied many years of practical experience developing software tools for multiprocessing and multiprocessor systems, culminating in the latest Toolset products. Application developers migrating from simple single processor systems to transputer-based multiprocessor systems will find Toolset software helps in the critical areas of partitioning a system for multiple processors and allowing such a system to be debugged.

There are three Toolset offerings which allow application programs to be developed in ANSI C, occam or C++. The ANSI C and occam Toolsets allow assembly code inserts to be used within the supportive framework of the higher level language. The Toolsets are fully compatible and allow mixed language programming through easy to use cross-language interfaces.

ANSI C Toolset



Features

An ANSI C compiler supporting macro assembly language inserts

A librarian tool

A full set of ANSI libraries plus libraries for interprocess communication

A linker tool

Configuration tools allowing systems to be partitioned and interprocess communication channels assigned, all through a C-like configuration language

ROM program support

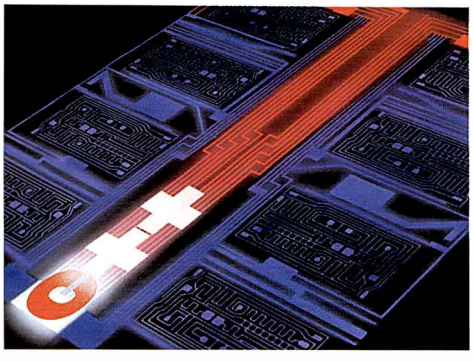
Debugging of processor/process networks at both transputer instruction level and source level (ANSI C, occam and C++)

Product code: **IMS Dx214**

The INMOS ANSI C Toolset is one of the highest quality ANSI C platforms for microprocessor systems development. Major objectives behind the design of this product include quality, reliability, ease of use, adherence to standards and high functionality. The INMOS ANSI C Toolset is one of the first ANSI C compliant products to have been validated by the British Standards Institute and approved under their CertWare programme.

By choosing to create such a high quality development environment, applications developers will find that their programs can be developed more quickly and are more likely to work first time and stay working. ANSI C compliance also means that programs may be easily ported between the transputer and other microprocessors.

C++ Toolset



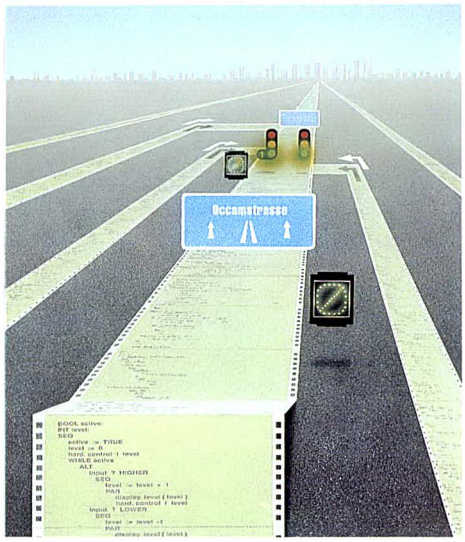
C++ is rapidly becoming the language of choice for many systems developers. INMOS has chosen to offer C++ on the transputer by assisting Glockenspiel to port their C++ system to work with the INMOS ANSI C Toolset.

C++ provides an excellent framework in which to develop transputer programs, allowing features such as operator overloading and reusability of functions to reduce the effort and time required to develop applications. C++ provides a strongly typed language which improves data integrity over equivalent standard C programs. As C++ programs are normally created from series of building blocks, these programs can readily be partitioned for multiprocessor systems based around the transputer.

The Glockenspiel C++ Toolset uses the INMOS ANSI C Toolset to support C++ program building and execution. Using the standard interface from C++ to C, it is a simple process to use C++, ANSI C and occam functions within the same program unit and use the INMOS Toolset debugger on the different language code segments.

Product code: **IMS Dx217**

occam Toolset



The language occam was developed by INMOS to maximise the performance of transputer systems. occam has a wide range of users ranging from commercial organisations wishing to exploit the speed and functionality of the transputer through to academic research into programming concurrent systems and describing concurrent algorithms.

occam is a lightweight language based around the concept of Communicating Sequential Processes. It uses simple language constructs and extensive type and usage checking to reduce development timescales and improve program correctness. occam allows sequential and parallel code segments to be written concisely, and low overhead communications channels to be created and used quickly. It also provides a simple high level abstraction to some of the more complex groups of transputer instructions which may be difficult to use directly.

The occam Toolset is structured in much the same way as the ANSI C Toolset with a wide range of tools supporting the occam compiler, occam language configurer and occam libraries. The occam compiler contains assembly language insertion facilities to mix assembly language programming into an occam framework with full access to occam variables. The occam libraries provide support to the occam run time system as well as providing maths functions, access to a host operating system and string and type manipulation functions.

Product code: **IMS Dx205**

ALSYS Ada Compiler

Features

- Supports distributed Ada applications
- Sharing of Ada libraries across networks
- Ada specific optimisations
- Compile-time and run-time diagnostics
- Multi-level priority, preemptive scheduling and user controllable timeslicing
- Interface to occam 2 Toolset (IMSDx205)

The Alsys Ada Transputer Compiler offers a complete production quality Ada environment suitable for the development of demanding applications on transputers. The compiler runs on an IBM PC (mothered on a T8xx transputer) or VAX/VMS. The compiler is both self targeting and capable of generating code for T4xx and T8xx transputer models. The compiler was validated by the United States Government Ada Joint Program Office. The AdaMap product contains an Ada like configuration language, Ada typing across partitions and support for debugging multi-processor networks.

Networking Solutions

Ethernet to Transputer Gateway

Features

Fast efficient standardised communications using a full implementation of the TCP/IP protocol suite

Simple low cost connectivity - standard IEE802.3 Ethernet interface to local transputer networks

High reliability single-ended and differential link communications - differential link interface gives reliable communications over long distances and in electrically noisy environments

Compact desktop design suits offices, laboratories or computer rooms

Compatible with IMS B019 differential system port board

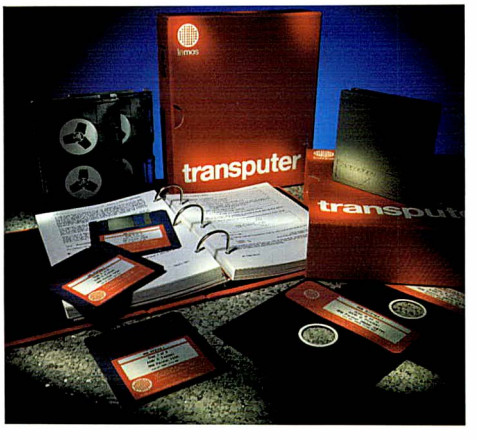
Designed for use with IMS Sx07 Connection Manager Software (available separately)

Product code: **IMS B300**

The IMS B300 unit provides interfacing from multiple host computers on an Ethernet network to up to 4 transputer subsystems. Communications on the IMS B300 are based on the TCP/IP protocol for message passing on standardised networking hardware. This provides users of Sun, VAX/VMS and IBM PC host computers with a flexible, high performance interface to transputer systems.

Efficient resource management is achieved by connection from multiple host machines to the IMS B300. This avoids the need for dedicated host-specific motherboards and ensures optimum resource utilisation by distributing transputer resources within a computer network. Resource control is completely invisible to users, with contention control taking place wholly within the IMS B300 unit.

The IMS B300 provides full upwards compatibility for all transputer applications using the standard INMOS ISERVER protocol. The server programs, running on different types of host machines, present users with a standard user interface. Using the socket library support, the IMS B300 enables stand-alone transputer systems to transfer data over Ethernet without the need for host interaction.



Connection Manager Software

Features

A software support package for the IMS B300 Ethernet to Transputer Gateway.

Fast efficient standardised communications using a full implementation of the TCP/IP protocol suite

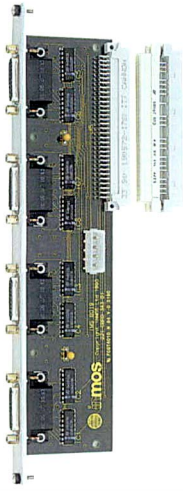
Data transfer without host interaction—socket library support enables stand-alone transputer systems to transfer data independently over Ethernet

Available for Sun, VAX/VMS and IBM PC hosts

Product code: **IMS Sx07**

Transputer applications may be developed for client/server applications using BSD style sockets to transfer data between the transputer and any host on an Ethernet network supporting BSD sockets.

Differential System Port Board



Features

Buffers all link and control signals to RS422 compatible differential signals.

Handles four systems, each containing one link, sub-system control up, and subsystem control down.

Capable of 20Mbit/s link operation.

Links go quiet when disconnected.

Designed for 100Ω twisted pair cable.

±7V common-mode noise rejection.

Size: 233×52mm.

Compatible with IMS B300 Ethernet to Transputer Gateway and IMS B250 VME Rack

Product code: **IMS B019**

The IMS B019 is a link communication enhancement board which provides two important data communications features. These are improved noise immunity and connections between equipment with different electrical environments. No common ground connection is required, reducing earthing problems. With cable lengths up to 10m, 20Mbit/s link speed is possible. (Longer cables up to 100m) support lower link speeds.

System Support

VME Rack

Features

12 slots for 6U VME boards

Accommodates INMOS VMEbus boards such as the IMS B014 and IMS B016

Built-in power supply capable of delivering 40A at 5V and 2x6A at 12V

Built-in forced air cooling

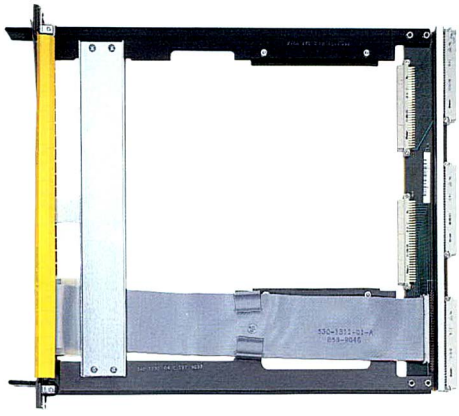
Available for 110-120V or 220-240V operation

Product code: **IMS B250**

The IMS B250 VME rack is a cabinet that will accommodate up to 12 INMOS VME boards, such as the IMS B014 VMEbus motherboard and IMS B016 VMEbus master/slave board. The IMS B250 will also accept other VMEbus boards including disk storage.

The IMS B250 provides a simple means of connecting transputer boards together with the necessary power supply and cooling requirements to provide the potential for supercomputing power.

6U Card Frame Adapter



Features

6U to 9U card frame adapter for Sun workstations

Required to enable 6U size VME boards (for example IMS B014 and IMS B016) to be used with Sun workstations with 9U size backplanes

Isolates the P2 user-defined pins from the backplane

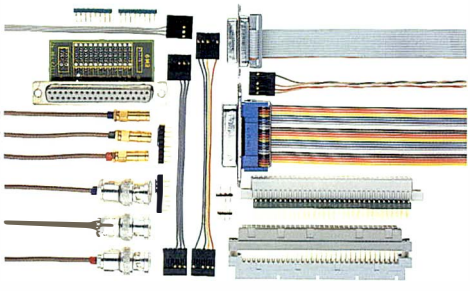
Product code: **IMS CA12**

Some VMEbus compatible card cages, notably Sun workstations, make use of the user defined pins on connector P2. It is extremely important that INMOS VME cards such as the IMS B014 and IMS B016 are not plugged into such a card cage because permanent damage to the VME card and/or Sun can result.

Although this restriction only applies to some slots in some kinds of Sun (and probably other card-cages) users should always be aware of this risk.

The solution required for the Sun is to use the IMS CA12 card frame adapter which isolates the P2 user-defined pins from the backplane.

Cable Sets

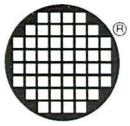


A range of cable sets are available to complement the INMOS range of board products. Sufficient cables are included with each of the INMOS board products to build the most common configurations. However, where more sophisticated systems are required, it will sometimes be necessary to use additional cables. The table overleaf indicates the number of each cable type included in each of the available cable sets.

Cable Sets (cont)

	Cable Reference Code																
Part No.	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**M**	**N**	**O**	**P**	**Q**	**R**
IMS CA01					10	2	1	1									
IMS CA03	10	10	1	1													
IMS CA04				3				1									
IMS CA09									3	10	10						
IMS CA11												1					
IMS CA12	6U card frame adaptor. Refer to page 29.																
IMS CA13													1				
IMS CA14														1			
IMS CA15															1		
IMS CA16																1	
IMS CA17																	1

Code	Description
A	10cm long link cable, terminated by two standard link connectors
B	50cm long link cable, terminated by two standard link connectors
C	1m long link cable, terminated by two standard link connectors
D	2m long link cable, terminated by two standard link connectors
E	10cm long reset cable, terminated by two standard reset connectors
F	50cm long reset cable, terminated by two standard reset connectors
G	1m long reset cable, terminated by two standard reset connectors
H	2m long reset cable, terminated by two standard reset connectors
I	3 x 1 pin strip, suitable for routing subsystem signals between TRAMs and motherboards
J	8 x 1 TRAM pin extender strips, suitable for raising TRAMs above components mounted on motherboards
K	8 x 1 pipe jumper strips, suitable for maintaining the link pipeline structure on motherboards
M	37-way 'D' type connector to standard link pin convertor; for use with some motherboards (e.g. IMS B008, IMS B014, IMS B017)
N	1m long RGB cables terminated at one end with SMB connectors and at the other with BNC connectors. These are suitable for use with the IMS B419 graphics interface TRAM
O	50 cm long ribbon cable designed to connect a GPIB interface TRAM (IMS B421) to the standard IEEE-488 bus.
P	2m long differential link cable for use with IMS B300 and IMS B019.
Q	1m long single ended link cable for use with IMS B300.
R	4 x 1m long video cables. SMR at one end and BNC at the other. For use with IMS B437 compact display TRAM.



Customer Support

The corporate priority of SGS-THOMSON is service, and INMOS, as part of the SGS-THOMSON Microelectronics Group, is committed to this.

Total Quality Management

In order to be recognised as the industry's number one service company, SGS-THOMSON is dedicated to Total Quality Management (TQM), based on five key elements:

- Management commitment
- Employee empowerment
- Fact-based decision making
- Continuous improvement
- Customer focus

The corporate service strategy, the internal Excellence Program, and the adoption of Statistical Process Control (SPC) reflect this dedication.

Product Support

A major contribution to customer support is the product itself. Easy to use designs, packaged with sophisticated software and comprehensive documentation, ensure that the system integrator is fully equipped to exploit the *i*q systems range of products.

Development System Support

The provision of a quality multiprocessing development environment is key to the success of the transputer and associated products. This means not only providing the right development tools but also the complete support environment.

Field Support

The INMOS Field Application Engineer (FAE) support network is able to provide on site professional guidance regarding the use of all *i*q systems products. This extends from project definition through to the final product, and includes assistance on the use of all INMOS development tools. All FAEs are fully supported by INMOS headquarters, where a database tracking system is used for queries and problem reports to ensure they are dealt with promptly and competently.

Regional Technology Centers

Support is also available from the worldwide Regional Technology Centers (RTCs). These are fully resourced with engineers and dedicated equipment to provide a range of services at a local level:

- Software support
- Consultancy
- Training
- Special project assistance

After Sales Service

INMOS operates a fast failure return procedure for its *i*q systems products. In the event of an in-service product failure, a replacement part will be supplied. A full investigation into the failure will be undertaken and a report made available to the customer. This ensures that continuity of supply is maintained at all times.

User Support

INMOS actively supports the large number of Transputer User Groups that have been established around the world. Many thousands of members from commercial and academic organisations meet regularly to share the latest developments in transputer technology.

Quality Assurance

Systems products are embraced within the INMOS Quality Policy which incorporates specific programmes in the following areas:

- Design in quality
- New product verification phase
- Document control
- Quality control monitors
- Production soak testing
- Reliability testing
- Software engineering standards

All systems products are designed in-house using CAD facilities specific to PCB manufacture. These facilities incorporate design simulation and provide production data which helps to reduce design to production problems.

During the product verification phase, the new product is evaluated and its build/test specifications are endorsed.

All systems products are assembled and tested at approved assembly houses which conform to the INMOS Quality Program. Quality procedures detail the build specification, production testing and final product status. These procedures are all monitored and controlled by the Document Control Department (DCD).

In-circuit automatic testing provides an effective monitor to the production phase by providing assembly and component analysis.

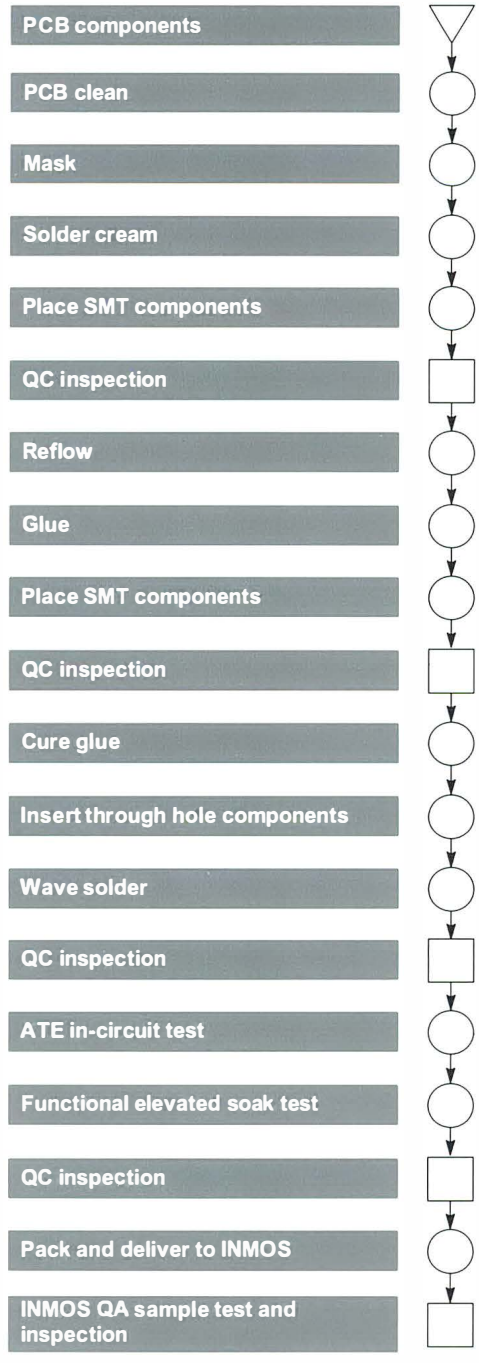
A Quality Assurance sample test evaluates all production batches. At this stage the conformance of the product is confirmed and the test data logged for reference.

Reliability testing is carried out on the major product lines. Samples are taken from standard stock and subjected to life testing.

Software is produced to INMOS software engineering standards, which encompass design methods, design verification, configuration management, coding practices, inspection and test procedures, and build and release controls.

Production media is manufactured by approved copy houses, and an INMOS Software Quality Assurance sample test evaluates all production batches.

Product Flow Example



Other Associated Literature

- Transputer Development and *i*q systems Databook
- Transputer Family Brochure
- Transputer Development Brochure
- The Transputer Databook
- Transputer Applications Notebook: Architecture and Software
- Transputer Applications Notebook: Systems and Performance
- Transputer Instruction Set / Compiler Writer's Guide
- occam2 Reference Manual
- A Tutorial Introduction to occam Programming

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